REVIEW ARTICLE

HEEL PAIN WITH AN OSTEOPATHIC COMPONENT

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ABSTRACT:

Family medicine is a field that is exposed to a large amount of musculoskeletal complaints. More than 100 million people present with musculoskeletal disease annually in the United States. This translates to over $320B in healthcare costs per year. Due to these astonishing numbers, it is imperative that family medicine physicians, who typically make up the first line of management, properly identify the many causes of musculoskeletal pain. Heel pain is a common complaint of patients seeking professional care. Due to the complex anatomy of the foot, identification and proper management can be challenging and thus prolong care. The present article reviews the anatomic structure, clinical evaluation, differential diagnoses and diverse treatment with an osteopathic approach surrounding the foot and ankle.

INTRODUCTION

In the United States, more than 100 million people suffer from musculoskeletal disease annually, representing nearly one in every three persons. As for adults over 18 years of age, 17–42% experience foot pain, with an upsurge in prevalence as age increases.[1] Family medicine trained physicians encounter the bulk of musculoskeletal complaints, as they are typically referred to as the gatekeepers in health care. According to recent medical school research in 2015, musculoskeletal focused rotations were offered in only 34% of medical schools, based on the curriculums of programs listing on the American Association of Medical Colleges website.[2] Then, a study based out of Michigan State University in 2018 revealed that only 54% of the students surveyed thought their musculoskeletal education was adequate.[3] Due to the annual number of musculoskeletal injuries and the potential for an exponential increase in the incidence in the future, musculoskeletal pathology should be an area of study reviewed.

This paper will review the epidemiology of heel pain, anatomy of the hindfoot, etiologies in adults, clinical approach and management in a family practice setting. The clinical approach will be based on osteopathic practice and principles. Osteopathic manipulative treatments will be discussed that can be used to treat common heel pain pathology.

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Anatomy Review

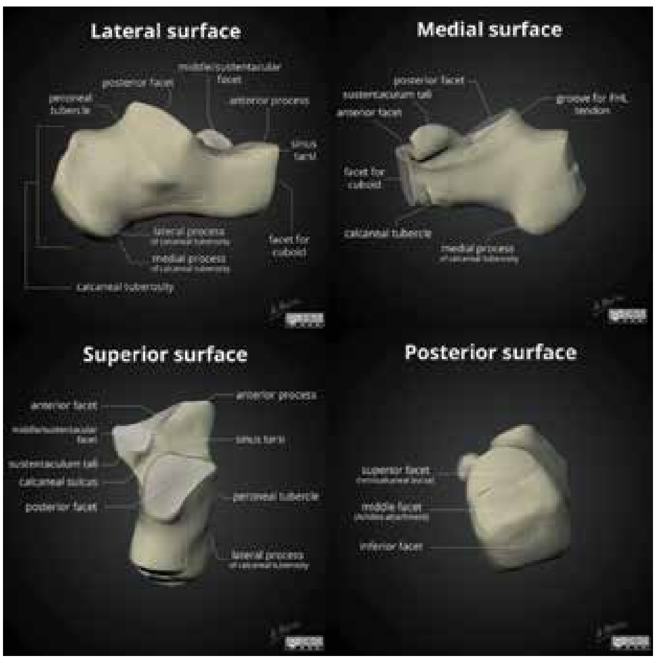
The foot and ankle are complex specialized anatomic structures working in a synchronized fashion to provide function and weight-bearing stability. The foot can be divided into three sections: the hindfoot, midfoot and forefoot. For the purpose of this article, we will emphasize the structures of the hindfoot.

The hindfoot is the most proximal portion of the foot and it consists of two main boney structures, the talus and calcaneus. These structures contribute to inversion and eversion of the foot via the subtalar joint. The other joints of the hindfoot are the transverse tarsal, calcaneocuboid and calcaneonavicular joint. The collaboration of all three joints allows for proper stability and flexibility during gait. When the subtalar joint is inverted, the transverse tarsal joint is locked and allows for stable toe push-off. When the subtalar joint is everted, the transverse tarsal joint unlocks and allows the foot to stabilize to accommodate heel strike.[4]

The calcaneus provides the skeletal framework of the foot. Located inferior to the talus, the calcaneus is positioned along the midline axis of the foot to aid in stability. The surface anatomy of the calcaneus has multiple facets and structures that serve as attachments for fascia, tendons and ligaments. Located on the superior surface are two large facets that are the sites for tarsal articulation with the talus. In between the facets is the calcaneal sulcus, in which congruence with the tarsal sulcus forms the sinus tarsi. The sinus tarsi is a significant structure of the hindfoot, composed of several neurovascular structures, ligaments and fat. Located on the inferior or plantar surface is the calcaneal tuberosity, for which the plantar aponeurosis attaches. The medial and lateral sides of the tuberosity run the abductor hallucis and abductor digiti minimi tendons, respectively. The medial surface hosts the sustentaculum tali. On the inferior aspect of this boney protrusion exists a groove containing the flexor hallucis longus tendon. The lateral surface is the site of the peroneal tubercle, which supports the peroneus brevis and peroneus longus tendons and a small protuberance for the calcaneofibular ligament attachment. The anterior surface contains the facet for articulation with the calcaneocuboid joint. Finally, on the posterior surface of the calcaneus is the calcaneal tuberosity, to which the Achilles tendon attaches.[4,5,7] (Figure 1.1) The calcaneus receives its blood supply from anastomosis between branches of posterior tibial and fibular arteries. Branches of the posterior tibial and sural nerves innervate the structures that pass along the calcaneus.[6]

FIGURE 1.1:

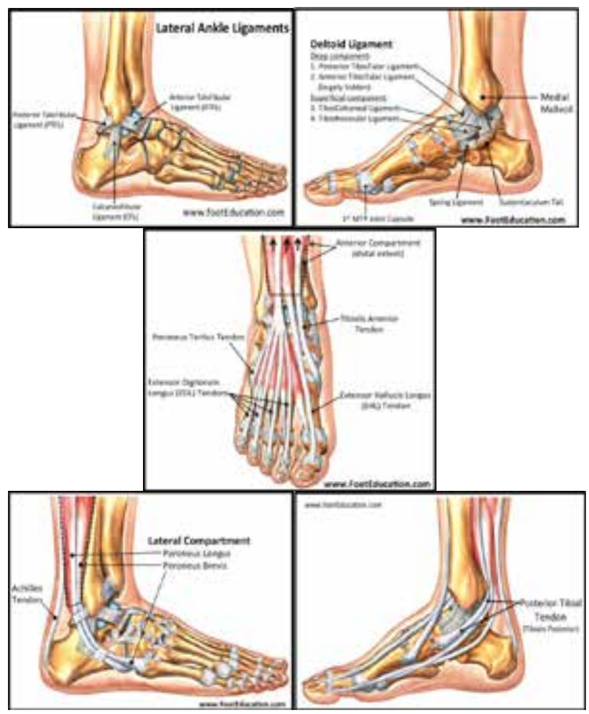
Anatomy of Calcaneus



The second bone of the hindfoot, the talus, is a major contributor to foot biomechanics. It is responsible for distributing the downward forces transmitted from the body when erect or in motion. This saddle-shaped tarsal bone articulates with the calcaneus, navicular and tibia and fibula to form the ankle joint. Although the talus doesn't have any tendon insertions, it has multiple ligamentous attachments that provide stability to the ankle. The largest ligament is located on the medial side and is called the deltoid complex ligament (DCL). The DCL is composed of superficial and deep ligament components. The superficial posterior tibiotalar ligament (SPTL), tibiocalcaneal ligament (TCL), tibiospring ligament (TSL), tibionavicular ligament (TNL), posterior tibiotalar ligament (PTTL), deep tibiocalcaneal ligament (dTCL) and anterior tibiotalar ligament (ATTL). The collaboration of the ligaments in the DCL aid in the restriction of talar eversion and posterolateral translation and abduction. The other main ligament on the medial side of the talus is the spring ligament which participates in maintaining the longitudinal arch of the foot. On the lateral side of the talus, attachments of the anterior talofibular ligament (ATFL), which is the most common sprained ligament in foot inversion injuries and the posterior talofibular ligament. It is important to mention that the posterior tibial tendon runs posterior to the medial malleolus and inserts on the navicular but plays an integral role in foot plantarflexion, inversion and supination. The talus receives blood supply primarily from a coalition of the posterior and anterior tibial artery and peroneal artery. Due to the lack of muscle attachments to the talus, it lacks the potential for secondary blood supply. Thus, increasing the risk of avascular necrosis in traumatic displaced fractures. The structures surrounding the talus are innovated by the posterior tibial and saphenous nerve on the medial side and branches of the peroneal nerve on the other sides.[5,6,7] See Figure 1.2: Anatomy of Hindfoot for visualization of key structures that make up the hindfoot.

FIGURE 1.2:

Anatomy of Hindfoot



Osteopathic Approach

The philosophical approach of osteopathy is heavily reliant on the entire patient's principles, models, and well-being. A.T. Still emphasized the importance of the musculoskeletal system in relation to the entire body's function and unity, and compared the human body to a machine that it is subject to mechanical laws. He hypothesized that by returning structures to their natural position, the body would function in equilibrium. Four principles or tenets define the foundation of osteopathy: 1) the body is a unit of mind, body and spirit, 2) it has its own self-protecting and self-regulating mechanisms, 3) structure and function are reciprocally interrelated and 4) treatment considers the proceeding three principles.[8,9] In other words, it is an integration of physical, psychological, social and spiritual components that influence the health and wellbeing of the person. The human body is constantly adapting to maintain equilibrium. One of the major regulating mechanisms is reliant on the neurological system. Transmission of nociceptor pain signals in the foot has both efferent and afferent pathways, thus enabling the ability to experience various forms of pain. Two of the main categories for classification are physiologic and pathologic pain. Physiologic foot pain enters from an acute response to injury, while pathologic foot pain comprises a dysfunctional nervous pathway such as neurogenic or inflammatory foot pain.[10] Due to neural plasticity, or the ability of neurons to self-regulate, there are changes in pain perception and functional compensation over time. In the case of heel pain, it can precipitate dysfunction in gait and result in structural compensation by altering the biomechanics of the rest of the body.

According to osteopathic philosophy, the human body is a complex figure composed of many interconnections that complement each other and work synchronously to achieve function and well-being.[5,10,11] The structural and functional relationships can be categorized into five models. The biomechanical model encompasses the skeletal framework of the body and the mechanisms that influence dynamic function. The respiratory/circulatory model corresponds to the intercellular and intracellular interactions of nutrients, oxygen and cellular waste. The neurological model focuses on the influences of the autonomic nervous system on the somatic and visceral systems. The bioenergetics model recognizes the molecular metabolism of energy and its response to various stresses. Finally, the biopsychosocial model focuses on the wellbeing of the patient. In 1980, George Engel proposed the biopsychosocial model to the osteopathic philosophy.[12] The patient's individual emotional and physiological influences can significantly affect their disease progression. This includes, but is not limited to, environmental stressors, socioeconomic factors and psychological factors.[13]

In the previous section, we discussed the anatomy of the hindfoot. The structures situated in that area contribute significantly to the biomechanics of the gait cycle and maintaining postural stability. With the calcaneus being the primary site of impact during the gait cycle and its associated joints being responsible for weight distribution, it is reasonable to assume that heel pain will affect the rest of the body. With the biomechanical model in mind, heel pain during gait results in alterations in the normal physiologic cycle.[14] Compensations to avoid pain can result in additive stress to other joints like the knees, hips and back. Abnormal mechanics can lead to an increased risk of injury. Regarding the biopsychosocial model, patients who have suffered lower extremity injuries are associated with anxiety and depression.[15,16]

Epidemiology & Risk Factors

In the general population, the prevalence of heel pain is 9.6%.[17] Due to the extensive list of diagnoses possible involving the nonspecific complaint of pain, correctly recognizing and treating the etiology of heel pain can be delayed. This can lead to prolonged discomfort, social suppression in terms of anxiety and depression, and even functional disability.[15,16,17] According to the Manchester Foot Pain and Disability Index, 98.4% of adults older than 50 years old experienced some days of disability from foot pain, and 74.2% reported most days.[18] Although adults over the age of 50 are the leading population presenting with heel pain, 28.6% of patients were 18–44 years old, and 7.7% were younger than 18.[18] In the younger patients, about 10% were athletes that participated in running intensive sports, like soccer, cross country and basketball.[19] Other factors that have a higher predominance to heel pain are the female sex, increased BMI, manual labor occupations, disrupted biomechanics and anatomic abnormalities.[20,21,22]

Clinical Evaluation

A thorough history and physical exam are essential for correctly identifying the diagnosis. According to a study, 66% of clinicians correctly identified the diagnosis on history taking alone.[23] Patients typically present to the clinic with heel pain, complaining of localized pain at the heel, swelling, stiffness or difficulty ambulating.[24] A family physician should cover an extensive list of questions during the patient encounter. A family medicine physician's focused approach to establish a thorough history is summarized in Figure 2.

FIGURE 2:

Family medicine approach to history taking in patients presenting with heel pain.

PAIN ASSESSMENT	
Location	Diffuse or localized to a specific spot
Chronicity/Onset	Acute or chronic, when did the pain begin?
Quality	Sharp, achy, pull, burning
Severity	Pain scale 1- 10 at rest, weight bearing, and during activity
Radiation	Does the pain spread distally or start proximally?
Aggravating factors	Weight bearing, walking, running, jumping, sport activity, shoe wear, stairs, uneven grounds, how long can you perform the activity before becoming symptomatic?
Relieving factors	Non weight bearing, ice, heat, NSAIDS, stretching, osteopathic manipulative medicine, shoe wear
Timing	Better or worse at any time of day, morning, night, does the pain disrupt sleep?
SWELLING ASSESSMENT	Unilateral, bilateral Precipitated by activity Duration of swelling Severity: site specific, extension into foot, ankle, or calf Any skin changes: ulceration, erythema, ecchymosis
ACTIVITY ASSESSMENT	Any new exercise or training regimens: describe how you progressed with intensity Sports participation? Shoe wear: new, old, support Occupation: active or sedentary

FIGURE 2 CONT'D:

TRAUMA ASSESSMENT	History of trauma? Previous experience of this pain? If so, where you seen by a physician? What was the diagnosis and management? Did the treatment help? Was there any imaging done? Of what?, When?, Did you bring them? Secondary joint pain: hips, knees, ankles
MEDICAL HISTORY ASSESSMENT	Diabetes/peripheral neuropathy Peripheral vascular disease/cardiac history Rheumatologic disease: Lupus, Rheumatoid arthritis, inflammatory arthropathy Low back pain, sciatica, radiculopathy Previous surgeries? Medications? Allergies? Family history of heel pain or skeletal deformities? Activity level
RED FLAGS	Neoplasm Spinal neuropathy B-symptoms: night sweats, unwarranted weight loss Incontinence, lower extremity weakness, numbness

The physical exam begins the moment the patient walks back from the waiting area to the exam room. If possible, observing a patient's gait from chair rise in the waiting room to sitting on the exam table can provide helpful information. For this article, an assessment of only the heel will be discussed. All examinations of extremities should be compared to the contralateral side for accurate assessment. To accurately assess the heel, the patient should remove any shoe wear and socks.

The clinician should start with an inspection of the footwear. Analyzing wear patterns on the patient's shoes and calluses on the feet can provide subtle indicators of abnormal gait and potential heel complications. Patients with a valgus hindfoot alignment are associated with an increase in stress applied to the Achilles tendon.[25] A neutral hindfoot alignment demonstrates a more uniform wear pattern, while a valgus and varus alignment demonstrates predominantly lateral and central wear patterns respectively.[25,26] Once inspection of shoe wear patterns is completed, the clinician should transition to inspecting the lower extremities in the erect position. Alignment should be assessed, noting any pelvic tilt and knee varus or valgus. Inspection of the foot arches while the patient is weight-bearing can demonstrate if the patient has anatomic deformities, such as pes plantus or pes cavus. Finally, inspect all heel surfaces, assessing for any signs of deformity, edema or ecchymosis.

Palpation of key anatomic structures should start proximally on the lower extremity and work distally. Table 1 outlines a list of key structures that should be palpated during a foot and ankle exam. All surfaces of the foot should be evaluated for tenderness and assessment in temperature, pulses and sensation bilaterally. To accurately examine the foot and ankle structures, a clinician should develop their systematic order of palpation that is reproducible in all scenarios.

TABLE 1:

Systemic order for palpating key structures during a heel exam.

SURFACE	STRUCTURES
Lower leg	Proximal fibular head, popliteal region, gastrocnemius muscle
Dorsal	Ankle mortise, anterior inferior tibiofibular ligament, tibialis anterior, extensor hallicus longus, extensor digitorium longus
Lateral	Lateral malleolus, peroneal tendons, sinus tarsi, anterior talofibular ligament, calcaneofibular ligament, calcaneocuboid joint, cuboid bone, base of 5th metatarsal
Medial	Medial malleolus, tibiocalcaneal ligament, tibionavicular ligament, navicular bone
Posterior	Achilles tendon, retrocalcaneal bursa, subcutaneous bursa, calcaneal, posterior tibiotalar ligament
Plantar	Calcaneal tuberosity, calcaneal fat pad, plantar fascia

When a patient presents with foot and ankle pain, it is always a good idea to explore Ottawa Rules for fracture assessment. The rules for the ankle state that a clinician should order radiographs if one of the following are met: pain on palpation at the tip or posterior edge of the lateral and/or medial malleolus, or the patient is unable to bear weight for four consecutive steps. The rules for the foot specify for pain on palpation to the base of the 5th metatarsal, navicular, or inability to bear weight for four consecutive steps. Although these rules are designed to prompt the clinicians' suspicion for fracture, standing radiographs of feet can provide additional information indicating other etiologies of heel pain.

The clinician should perform both active and passive movement and muscle strength testing bilaterally for comparison. The physical examination techniques and special tests for heel pain are described in Tables 2 and 3, respectively.[27]

TABLE 2:

Physical examination techniques for heel pain

Ankle Range of Motion

MOTION	NORMAL RANGE (DEGREES)
Dorsiflexion	0 – 20
Plantar Flexion	0 – 50
Inversion	0 – 35
Eversion	0 – 15
Supination (inversion, adduction & plantar flexion)	0 – 60
Pronation (Eversion, abduction & Doriflexion)	0 - 30

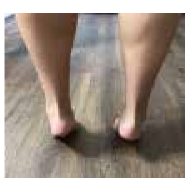
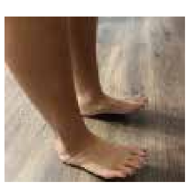
Muscle Strength Grading System

GRADE	EVALUATION
0	No muscle activation
1	Trace muscle activation
2	Muscle activation with gravity eliminated, full passive range of motion
3	Muscle activation against gravity, full active range of motion
4	Muscle activation against some resistance
5	Muscle activation against full resistance

Muscle Function Analysis

MUSCLE	PATIENT POSITION	CLINICIAN MANEUVER
Extensor digitorum longus/brevis	Extension of digits 2 - 5	Isolate tendon by stabilizing the digits at the metatarsophalangeal joints, flex digits against resistance
Extensor hallucis longus/brevis	Extension of hallux	Isolate tendon by stabilizing the hallux at the metatarsophalangeal joint, flex hallux against resistance
Flexor digitorum longus/brevis	Flexion of digits 2-5	Isolate tendon by stabilizing the digits at the metatarsophalangeal joints, extend digits against
Flexor hallucis longus	Flexion of hallux	Isolate tendon by stabilizing the hallux at the metatarsophalangeal joint, extend hallux against resistance
Gastrocnemius, Soleus, Plantaris	Ankle plantar flexion	Dorsiflex against resistance, special tests to differentiate
Peroneal longus/ brevis	Ankle eversion and plantar flexion	Medial force applied on lateral foot against resistance, palpate tendons posterior to lateral malleolus
Tibialis anterior	Ankle dorsiflexion	Plantar flex against resistance, palpate tendons on dorsum of foot
Tibialis posterior	Ankle inversion and plantar flexion	Lateral force applied on medial foot against resistance, palpate tendons posterior to medial malleolus

Gait Analysis

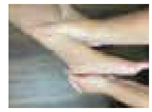
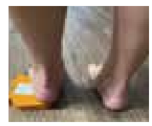
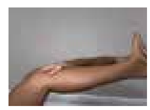
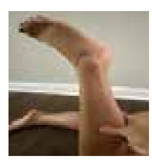
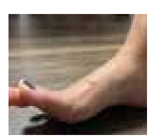
Normal gait analysis: ability to walk heel to toe without limp or compensation. Able to support weight walking on tip toes and then on heels.		
GAIT TYPE	EXAMINATION	EVALUATES
Tip toe		Tibialis posterior, Achilles tendon, posterior impingement, S1/S2 nerve root
Heels		Calcaneal fracture, plantar fasciitis, tibialis anterior, anterior impingement, L4/L5 nerve root

Hindfoot Alignment

Normal alignment: from anterior, should not visualize medial calcaneal fat pad. From posterior, should not see more than 4th & 5th digits laterally		
SIGN	**EXAMINATION**	**EVALUATES**
Peek-a-boo		Calcaneal varus, potential pes plantus
Too many toes		Calcaneal valgus, potential pes cavus

TABLE 3:

Special tests for heel pain.

TEST	MANEUVER	ABNORMAL	EVALUATES
Anterior Draw		>1 cm of anterior translation, laxity	Ankle sprain, specifically the ATFL
Calcaneal Squeeze		Pain	Calcaneal stress fracture
Coleman Block		Heel will remain in varus position	Flexibility of hindfoot (rigidity)
Silfverskiold		Greater degree of dorsiflexion in the ankle when knee is flexed to 90 degrees	Differentiates gastrocnemius muscle tightness from soleus
Talar Tilt		Laxity of talus, pain	Sub-talar motion
Thompson's		Lack or reduced plantar flexion of the foot	Achilles tendon function
Tinel's		Pain, numbness	Tarsal tunnel nerve entrapment
Windlass		Plantar fascia pain with limited MCP extension	Plantar fasciitis

Establishing a Diagnosis

Obtaining a thorough history has always been a fundamental component of the diagnostic approach. There is no reason to dissociate from that principle when trying to determine heel pain etiology. Following a step-by-step physical exam approach will help narrow the broad differential. Table 4 demonstrates a variety of possible causes of heel pain that a primary care physician may encounter. Figure 3 was designed to aid in the differentiation of musculoskeletal etiologies, while Figure 4 aims at alternative causes.

TABLE 4:

Differential Diagnosis, presentation, and treatment for heel pain complaints

HEEL SURFACE	ETIOLOGY	CLINICAL PRESENTATION	DIAGNOSTIC FINDINGS	TREATMENT
Medial	Flexor digitorum longus tendinopathy	Overuse injury, running on uneven surfaces such as sand	Tenderness along flexor digitorum longus tendon	Activity modification, rest, NSAIDs, PT
	Flexor hallicus longus tendinopathy	Overuse injury, repetitive push off and plantar flexion "dancers tendonitis"	Tenderness along flexor hallicus longus tendon	Activity modification, rest, NSAIDs, PT
	Posterior tibial dysfunction	Pain posterior to medial malleolus extending along medial arch	Pes Plantus, tenderness along posterior tibial tendon	immobilization for 6 weeks, rest, NSAIDs
	Tarsal tunnel syndrome	Nerve entrapment secondary to overuse injury, gradual onset of pain, paresthesia or burning sensation	Positive Tinel's test along posterior tibial tendon, electromyography, MRI	RICE, NSAIDs, immobilization, orthotics, surgery
Lateral	Peroneal tendonitis	Pain and swelling, exacerbated when rising onto the ball of the foot	Tenderness to palpation; reproducible symptoms upon active resisted eversion	Activity modification, rest, NSAIDs, PT, surgery
	Sinus tarsi syndrome	Pain with weight bearing and activity on uneven surfaces	Tenderness to palpation of sinus tarsi area and talar tilt	Activity modification, rest, NSAIDs, orthotics, corticosteroid injections, surgery
Plantar	Calcaneal stress fracture	Overuse injury, sudden increase in activity level, pain with activity	Tenderness at site, +/- X-ray findings, MRI demonstrate increased signal at site	Activity modification, rest, limit weight bearing, NSAIDs, shoe wear change/ orthotics
	Heel spur	Pain with prolonged activity, chronic plantar fasciitis	X-ray demonstrates enthesophytes	Activity modification, rest, NSAIDs, orthotics
	Heel pad syndrome	Dull achy pain	Tender to palpation in the middle of the heel	Shoe wear modification, heel cups, NSAIDs, RICE
	Nerve entrapment	Paresthesia with activity	Positive Tinel test over plantar nerves	Stretching, NSAIDs, activity modification
	Neuroma	Burning or numbness sensation, pain radiating to the ball of the foot, feels like there's a "pebble in your shoe"	Reproducible symptoms; Ultrasound demonstrating a hypoechoic mass parallel tometatarsals	Shoe modification (wide shoe box), metatarsal pad, corticosteroid injection, surgery
	Plantar fasciitis	Pain with first steps	Tenderness along plantar fascia	Activity modification, stretching, rest, corticosteroid injection
Posterior	Achilles tendinopathy	Trauma - jumping, laceration; acute/chronic - pain with activity	Positive Thompson test, palpable gap in tendon chronic injury- thickened Achilles tendon	Rupture - ortho referral; tear - slight plantar flexed cast; acute and chronic injury - activity modification, rest
	Bursitis	Pain, edema, erythema surrounding the Achilles	Tenderness Retrocalcanal - behind Achilles tendon, subcutaneus along calcaneus	Activity modification, RICE
	Haglund deformity -	Pain at the superior aspect of the posterior calcaneus	X-ray demonstrate deformity, abnormal bony structure in heel	Activity modification, RICE, NSAIDs

FIGURE 3:

Heel pain algorithm

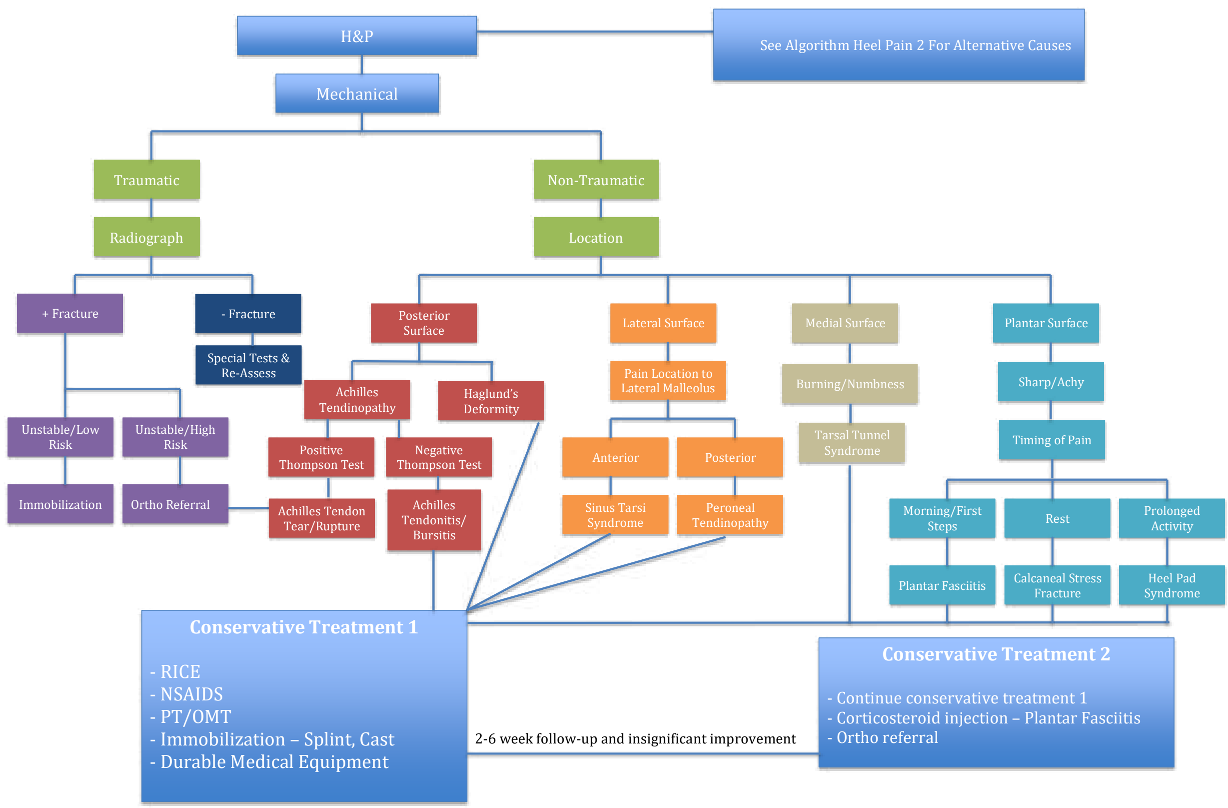
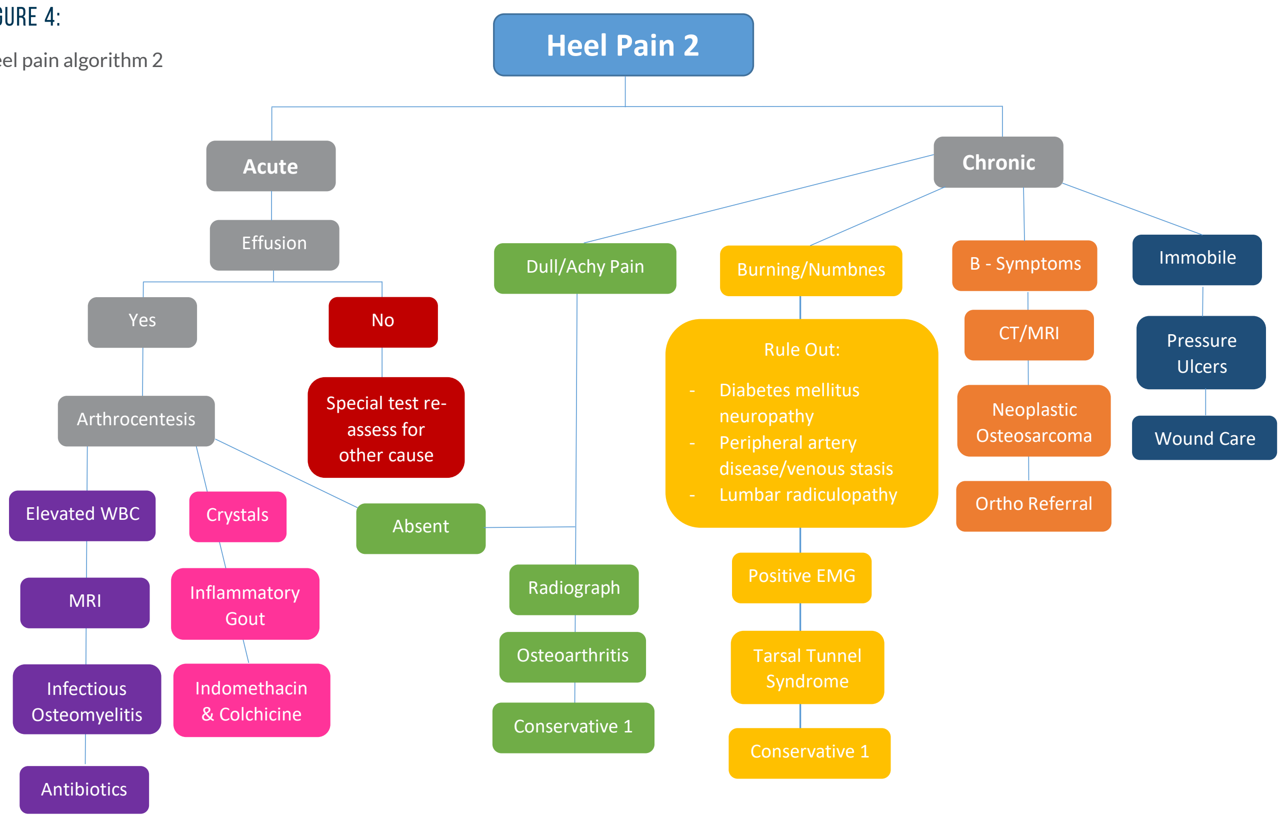


FIGURE 4:

Heel pain algorithm 2



Medical Management

For most musculoskeletal pathology and specifically heel pain, conservative therapy is typically a sufficient course of management. Conservative therapy consists of a combination of both pharmacologic and mechanical management. The pharmacologic aspect aims at managing pain and inflammation. When deciding which analgesics or anti-inflammatories to use, consider the duration of the management. For acute conditions, non-steroidal anti-inflammatory drugs (NSAIDs), such as over-the-counter ibuprofen (Advil), naproxen (Aleve) or prescription meloxicam (Mobic), may be used. Extended duration and inappropriate use of NSAIDs can result in gastrointestinal irritation, kidney injury and bleeding.[28] For chronic conditions, acetaminophen (Tylenol) or a selective COX-2 inhibitor, such as celecoxib (Celebrex), may be a safer option. Opioids should be avoided in acute injuries, as they are not typically part of the management guidelines. In a recent study involving the prescription of opioids following ankle sprains, Finney *et al.*, determined that primary care physicians were the second-highest specialty prescribing opioids to previous non-users within seven days of diagnosis. They also determined that 8.9% of those opioid-naive patients continued to use opioids more than 90 days post-diagnosis.[29] Since a majority of the heel pain etiologies encountered by family medicine physicians are treatable with conservative management, there is no indication for opioid medication use. Peripheral nerve pain can be described as burning pain or numbness in the feet. Although the complete list of etiologies are not expressed in this article, first-line medications such as gabapentin (Gralise®), pregabalin (Lyrica®), amitriptyline (Elavil®), duloxetine (Cymbalta®) or venlafaxine (Effexor®) can be used.[30]

A major component within conservative management is restoring alignment while strengthening and stretching contributory muscles. Physical therapy and/or osteopathic manipulative treatment is the mainstay treatment modality used to address these components. Also, immobilization and orthotic devices play a significant role in correcting alignment, maintaining stability, restricting mobility, shock absorption by offloading pressure and providing protection. There are a variety of immobilization devices that range from over-the-counter aids to custom-made orthotics. A descriptive list of appropriate devices is outlined in Table 5.[31] Appropriate shoe wear has also been shown to improve pain and function.[32]

TABLE 5:

Immobilization devices

TYPE	IMMOBILIZATION DEVICE	INDICATION	PHOTOGRAPH
Splint	Airheel	Achilles tendinopathy Plantar Fasciitis	
	Night splints	Plantar Fasciitis	
	Lace up Brace	Ankle sprain	
Ankle Foot Orthoses (AFO)	Static	Neuromuscular disorders	
	Hinged	Neuromuscular disorders	
	Richie Brace	Posterior tibial tendon dysfunction Peroneal tendinopathy Lateral ankle instability	
Molded Ankle Foot Orthoses (MAFO)	Arizona Brace	Posterior tibial tendon dysfunction Tibialis tendonitis Talocalcaneal varus or valgus	
Controlled Ankle Movement (CAM)	Short/Tall boot	Achilles tendinopathy Peroneal tendonitis Fracture/ post-surgical	

If conservative management fails, the use of intramuscular NSAIDs and corticosteroid injections have been shown to provide short-term relief but do not address the underlining pathology.[33] Ketorolac (Toradol®), an NSAID that can be administered as an intramuscular injection, has been shown to provide adequate relief of musculoskeletal pain. Before use, the renal function needs to be assessed, and duration is limited to five days, due to increased risk for gastrointestinal bleeding and colitis.[34] Corticosteroid injections are typically a combination of a steroid, for example, triamcinolone (Kenalog®) and an analgesic, such as lidocaine. The onset and lasting effects of intraarticular corticosteroid injections vary among patients. Corticosteroid injection therapy can cause atrophy of the heel pad, tendinopathy, bone demineralization and blood sugar elevation and thus should be limited to no more than three per year per joint. Corticosteroid injections have limited use in heel pain other than subtalar osteoarthritis or plantar fasciitis. Injections should never be placed in the Achilles tendon or other tendons in the foot, as it has been linked to causing weakening and rupture of the tendons.[35] An increasingly popular treatment option to treat a variety of musculoskeletal pathologies is the use of platelet-rich-plasma (PRP) injection therapy. PRP utilizes the body's natural growth factors and cytokines derived from host platelets to precipitate recruitment and proliferation of stem cell adhesion and angiogenesis.[36] A systematic review on corticosteroid injections for plantar heel pain published in 2019 determined that in the short term, corticosteroid injections were superior at pain reduction and improved function score when compared to PRP injections but the opposite in long-term outcomes.[37] An orthopedic referral should be considered when the patient continuously fails conservative management, symptoms worsen or the diagnosis results in an unstable function.

Role of Osteopathic Manipulative Treatment in Heel Pain

Correctly identifying the primary cause of heel pain can be difficult to pinpoint. The differential can be extensive, thus making treatment decisions more challenging. The incorporation of an osteopathic assessment and treatment can provide additional benefits. In cases presenting with vague pain and minimal findings on physical exam, osteopathic structural exams can hint at potential causes of discomfort. Osteopathic manipulative treatments emphasize the re-alignment and stretching of muscles to provide pain relief. For this article, the focus will be tailored to plantar fasciitis. In primary care, the most common cause of heel pain, accounting for about 60% of encounters, is plantar fasciitis.[38] The etiology of plantar fasciitis is predominantly secondary to overuse. It typically occurs in runners and people who spend excessive time on their feet. The repetitive cycle of elongating and shortening can cause degeneration of the fascia with potential microscopic tears. Tight gastrocnemius muscles and foot drop are two conditions that apply significant strain on the plantar fascia. With the foot having limited dorsiflexion capabilities, the plantar fascia is exposed to additional loading forces.[38] Plantar fasciitis is diagnosed clinically with the patient complaining of pain upon the first steps of the ambulation after a period of inactivity. The pain is typically described as a sharp pain located around the anteromedial portion of the plantar surface on the heel. Plantar fasciitis is typically treated conservatively, representing about 90% of the cases.[38] Osteopathic manipulative medicine can be beneficial in the recovery from plantar fasciitis and reduce foot and ankle edema.[39] Identifying and treating tight calf muscles with muscle energy or myofascial techniques can provide some biomechanical relief. Stretching of the gastrocnemius muscle has been shown to reduce the strain placed on the Achilles tendon and the plantar fascia.[40] Counterstrain techniques applied to the plantar fascia have also shown to have immediate improvements in cases of plantar fasciitis.[41,42] By placing the plantar fascia in a position of relaxation and maintaining that position for 90 seconds allows for the neuromuscular spindle to reset. This biomechanical mechanism educes relaxation of the influencing muscles that are affected. A list of potential osteopathic manipulative treatments are listed in Table 6 for reference.[4]

TABLE 6:

OMT techniques for heel pain

TECHNIQUE	REGION	DIAGNOSIS	PHYSICAL FINDINGS
		Anterior fibular head	Foot inversion and adduction, lower leg external rotation
		Posterior or fibural head	Foot eversion and abduction, lower leg internal rotation
	Ankle	Dorsiflexion	Dorsiflexion of foot
		Plantar flexion	Plantar flexion of foot
	Foot	Calcaneal eversion	Eversion of the calcaneus
		Calcaneal inversion	Inversion of the calcaneus
		Subtalar abduction	Talus abducted on calcaneus
		Subtalar adduction	Talus adducted on calcaneus
Counterstrain	Knee	Gastrocnemius tender point	Lateral and medial attachments in the inferior aspect of popliteal fossa
	Ankle	Medial ankle tender point	Inferior to medial malleolus
		Lateral ankle tender point	Inferior to lateral malleolus
	Foot	Calcaneus tender point	Distal end of calcaneus on the plantar surface of the foot
		Talar tender point	Anteromedial ankle, deep to talus
Facilitated Positional Release	Ankle	Midpoint and medial ankle	Ankle stiffness and muscle hypertonicity
Articulatory	Knee/ Ankle	Combined knee and ankle long-axis extension	Ankle stiffness

TABLE 6 CONT'D.:

OMT techniques for heel pain

TECHNIQUE	REGION	DIAGNOSIS	PHYSICAL FINDINGS
High Velocity Low Amplitude (HVLA)	Knee	Anterior fibular head	Pain on the lateral side of knee
		Posterior fibular head	Pain on the lateral side of knee with neurologic symptoms along peroneal nerve
	Ankle	Ankle eversion	Flat foot, pain on medial side of ankle
		Ankle inversion	High arch, pain on lateral side of ankle
		Tibiocalcaneal	Ankle pain and stiffness
Myofascial Ligamentous Release	Knee	Gastrocnemius	Hypertonicity of the gastrocnemius muscle, limited dorsiflexion of the foot
	Ankle	Achilles Tendon	Swelling surrounding the Achilles tendon
	Foot	Plantar Fascia	Pain and hypertonicity of the plantar fascia

CONCLUSION

Primary care physicians are presented with a substantial amount of musculoskeletal complaints. Due to the extensive possibilities, proper identification and management of heel pain can be challenging. Reiterating and establishing a strong foundation in the examination and assessment of foot pain is strongly encouraged. Since the majority of these conditions can be treated conservatively, an osteopathic approach to care can be effective. The osteopathic philosophy and the application of its various models provide an additional tool in the diagnosis and treatment of reported heel pain.

AUTHOR DISCLOSURES

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